What Is Claimed Is:

1. A composition for inhibiting nucleic acid synthesis, comprising a nucleic acid inhibitor that is capable of binding or has affinity to an enzyme with polymerase activity.

2. The composition of claim 1, wherein said nucleic acid inhibitor forms a hairpin or comprises a double stranded nucleic acid molecule.

3. The composition of claim 1, wherein said binding or affinity of said nucleic acid inhibitor to said enzyme is inhibited, reduced, substantially reduced, or eliminated under conditions for nucleic acid synthesis, amplification or sequencing.

4. The composition of claim 1, wherein said nucleic acid inhibitor is capable of forming a complex with said enzyme.

5. The composition of claim 1, further comprising one or more enzymes having polymerase activity.

6. The composition of claim 5, wherein said enzyme is thermophilic.

7. The composition of claim 1, wherein said nucleic acid inhibitor is denatured or has reduced capacity to inhibit under conditions for nucleic acid synthesis, amplification or sequencing.

8. The composition of claim 5, wherein said enzyme having nucleic acid polymerase activity is selected from the group consisting of a DNA polymerase, an RNA polymerase and a reverse transcriptase.

9. The composition of claim 8, wherein said DNA polymerase is selected from the group consisting of *Taq, Tne, Tma, Pfu,* VENT™, DEEPVENT™, KOD, *Tfl,* and *Tth* DNA polymerases, and mutants, variants and derivatives thereof.

10. The composition of claim 8, wherein said reverse transcriptase is selected from the group consisting of M-MLV reverse transcriptase, RSV reverse transcriptase, AMV reverse transcriptase, RAV reverse transcriptase, MAV reverse transcriptase and HIV reverse transcriptase, and mutants, variants and derivatives thereof.

11. The composition of claim 8, wherein said reverse transcriptase is substantially reduced in RNase H activity.

12. A method for synthesizing a nucleic acid molecule comprising:

mixing at least one enzyme with polymerase activity with one or more nucleic acid inhibitors of claim 1 and one or more templates; and

incubating said mixture under conditions sufficient to synthesize one or more first nucleic acid molecules complementary to all or a portion of said templates.

13. The method according to claim 12, wherein said mixing is accomplished under conditions to prevent nucleic acid synthesis and/or to allow binding of said nucleic acid inhibitor to said enzyme with polymerase activity.

14. The method according to claim 12, wherein said synthesis of said first nucleic acid molecule is accomplished under conditions sufficient to reduce the inhibitory affect of said nucleic acid inhibitor, and/or to inhibit, reduce, substantially reduce, or eliminate binding of said nucleic acid inhibitor to said enzyme with polymerase activity.

15. The method according to claim 12, wherein said synthesis is accomplished in the presence of at least one component selected from the group consisting of one or more nucleotides, and one or more primers.

16. The method according to claim 12, wherein said template is double stranded nucleic acid molecule.

17. The method of claim 12, further comprising incubating said one or more first nucleic acid molecules under conditions sufficient to make one or more second nucleic acid molecules complementary to all or a portion of said first nucleic acid molecules.

18. A nucleic acid molecule made according to the method of claim 12.

19. A method for amplifying a nucleic acid molecule comprising:

mixing at least one nucleic acid inhibitor of claim 1 with one or more enzymes with polymerase activity and one or more templates; and

incubating said mixture under conditions sufficient to amplify one or more nucleic acid molecules complementary to all or a portion of said templates.

20. The method according to claim 19, wherein said mixing is accomplished under conditions sufficient to prevent nucleic acid amplification and/or to allow binding of said nucleic acid inhibitor to said enzyme with polymerase activity.

21. The method according to claim 19, wherein said amplifying is accomplished under conditions sufficient to denature said nucleic acid inhibitor or reduce the ability of the inhibitor to inhibit amplification.

22. The method according to claim 19, wherein said amplifying is accomplished in the presence of at least one component selected from the group consisting of one or more nucleotides, and one or more primers.

23. The method according to claim 19, wherein said template is a double stranded nucleic acid molecule.

24. A nucleic acid molecule made according to the method of claim 19.

25. A method for sequencing a nucleic acid molecule, comprising:

mixing at least one nucleic acid molecule to be sequenced with one or more nucleic acid inhibitors of claim 1, one or more enzymes having polymerase activity, and one or more terminating agents;

incubating said mixture under conditions sufficient to synthesize a population of molecules complementary to all or a portion of said molecules to be sequenced; and

separating said population to determine the nucleotide sequence of all or a portion of said molecule to be sequenced.

26. The method according to claim 25, wherein said mixing is accomplished under conditions sufficient to prevent synthesis and/or to allow binding of said nucleic acid inhibitor to said enzyme with polymerase activity.

27. The method according to claim 25, wherein said synthesis is accomplished under conditions sufficient to denature said nucleic acid inhibitor and/or to reduce the inhibitory affect of said nucleic acid inhibitor.

28. The method according to claim 25, wherein said synthesis is accomplished in the presence of at least one component selected from the group consisting of one or more nucleotides, and one or more primers.

29. The method according to claim 25, wherein said molecule to be sequenced is a double stranded nucleic acid molecule.

30. A kit for use in synthesis, amplification or sequencing of a nucleic acid molecule, said kit comprising one or more of the nucleic acid inhibitors of claim 1.

31. The kit of claim 30, further comprising one or more components selected from the group consisting of one or more nucleotides, one or more DNA polymerases, one of more reverse transcriptases, one or more suitable buffers, one or more primers and one or more terminating agents.

32. A method for amplifying a double stranded DNA molecule, comprising:

providing a first and second primer, wherein said first primer is complementary to a sequence within or at or near the 3'-termini of the first strand of said DNA molecule and said second primer is complementary to a sequence within or at or near the 3'-termini of the second strand of said DNA molecule and one or more nucleic acid inhibitors of claim 1, under conditions such that said inhibitors prevent or inhibit nucleic acid synthesis;

hybridizing said first primer to said first strand and said second primer to said second strand to form hybridized molecules;

incubating said hybridized molecules under conditions sufficient to allow synthesis of a third DNA molecule complementary to all or a portion of said first strand and a fourth DNA molecule complementary to all or a portion of said second strand;

denaturing said first and third strand, and said second and fourth strands; and repeating (a) to (c) or (d) one or more times.

33. A method of preparing cDNA from mRNA, comprising

mixing one or more mRNA templates, one or more reverse transcriptases, and with one or more nucleic acid inhibitors of claim 1; and

incubating said mixture under conditions sufficient to synthesize one or more cDNA molecules complementary to all or a portion of said templates.

34. The method of claim 33, wherein said mixing is accomplished under conditions sufficient to prevent nucleic acid synthesis and/or allow binding of said nucleic acid inhibitor to said reverse transcriptase.

35. A method for inhibiting or preventing nucleic acid synthesis, amplification or sequencing comprising:

mixing one or more nucleic acid inhibitors of claim 1 with one or more enzymes having polymerase activity; and

incubating said mixture under conditions sufficient to inhibit or prevent nucleic acid synthesis, amplification and/or sequencing.

36. An oligonucleotide comprising a 5'- and a 3'-portion, wherein said 3'-portion comprises a series of contiguous deoxyribonucleotides or derivatives thereof and said 5'-portion comprises a series of contiguous ribonucleotides or derivatives thereof and wherein all or a portion of said 3'-portion is capable of base pairing to all or a portion of said 5'-portion.

37. The oligonucleotide according to claim 36, wherein said 5'-portion comprising ribonucleotides forms a 5'-overhang.

38. The oligonucleotide according to claim 36, wherein said the 3'-most nucleotide comprises one or more modifications so as to be non-extendable.

39. The oligonucleotide according to claim 38, wherein said modification is phosphorylation of the 3'-hydroxyl of the nucleotide.

40. The oligonucleotide according to claim 36, wherein said, comprising one or more modifications so as to be resistant to one or more nucleases.

41. The oligonucleotide according to claim 40, wherein said modification is a phosphorothioate.

42. The oligonucleotide according to claim 40, wherein said modification is a methylation of a hydroxyl group.

43. A method of inhibiting a polymerase enzyme within a cell, comprising:

introducing into a cell an oligonucleotide, said oligonucleotide comprising a 5'- and a 3'-portion, wherein said 3'-portion comprises a series of contiguous deoxyribonucleotides or derivatives thereof and said 5'-portion comprises a series of contiguous ribonucleotides or derivatives thereof and wherein all or a portion of said 3'-portoin is capable of base pairing to all or a portion of said 5'-portion; and

causing the inhibition of the polymerase with said oligonucleotide.

44. The method according to claim 43, wherein said 5'-portion of said oligonucleotide comprising ribonucleotides forms a 5'-overhang.

45. The method according to claim 43, wherein said polymerase is a reverse transcriptase.

46. The method according to claim 45, wherein said polymerase is HIV reverse transcriptase.

47. A method of inhibiting replication of a virus, comprising:

providing a virus, said virus comprising a reverse transcriptase and requiring activity of the reverse transcriptase for replication;

contacting said reverse transcriptase with an oligonucleotide that inhibits activity of said reverse transcriptase thereby inhibiting replication of said virus.

48. The method according to claim 47, wherein said oligonucleotide comprises a 5'- and a 3'-portion, wherein said 3'-portion comprises a series of contiguous deoxyribonucleotides or derivatives thereof and said 5'-portion comprises a series of contiguous ribonucleotides or derivatives thereof and wherein all or a portion of said 3'-portion is capable of base pairing to all or a portion of said 5'-portion.

49. The method according to claim 48, wherein said 5'-portion comprising ribonucleotides forms a 5'-overhang.

50. The method according to claim 47, wherein said virus is a HIV.

51. The method according to claim 47, wherein said contacting comprises introducing said oligonucleotide into a cell.

52. A method of treating a viral infection in a subject, comprising:

administering to said subject a composition comprising an oligonucleotide comprising a 5'- and a 3'-portion, wherein said 3'-portion

comprises a series of contiguous deoxyribonucleotides or derivatives thereof and said 5'-portion comprises a series of contiguous ribonucleotides or derivatives thereof and wherein all or a portion of said 3'-portion is capable of base pairing to all or a portion of said 5'-portion.

53. An oligonucleotide which binds or has affinity for one or more reverse transcriptases.

54. The oligonucleotide of claim 53, which comprises one or more ribonucleotides or derivatives thereof and one or more deoxyribonucleotides or derivatives thereof.

55. The oligonucleotide of claim 53, wherein said oligonucleotide is resistant to degradation or digestion.

56. A method of inhibiting one or more reverse transcriptases comprising:

contacting a sample or a cell with one or more oligonucleotides which binds or has affinity for one or more reverse transcriptases causing said oligonucleotides to inhibit the polymerase activity of said reverse transcriptases.

57. The method of claim 56, wherein said oligonucleotide comprises one or more modifications to inhibit or prevent degradation or digestion of said oligonucleotide.

58. A method of treating a viral infection in a subject comprising:

administering to said subject an effective amount of the oligonucleotide of claim 53; and

causing said oligonucleotide to inhibit or prevent said viral infection in said subject.

59. A pharmaceutical composition comprising the oligonucleotide of claim 53.